(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
20 June 2002 (20.06.2002)

PCT

(10) International Publication Number
WO 02/47934 A1

(51) International Patent Classification[7]: B60K 41/06, F16H 61/04

(21) International Application Number: PCT/SE01/02766

(22) International Filing Date: 13 December 2001 (13.12.2001)

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data:
0004606-0 13 December 2000 (13.12.2000) SE

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 02/47934 A1

(54) Title: AN ARRANGEMENT AND A METHOD TO DETECT A ZERO MOMENT IN A GEAR BOX

(57) Abstract: The present invention relates to an arrangement and a method for detecting a zero torque in a stepped gearbox. The arrangement comprises a first sensor (15) arranged to sense a first parameter related to the number of revolutions of the input shaft (4) of the gear box, a second sensor (16) arranged to sense a second parameter related to the number of revolutions of the output shaft (6) of the gear box and a control unit (11) arranged to receive measurement values concerning said first and second parameter. The control unit (11) is thereafter arranged to compare if the number of revolutions of the input shaft (4) of the gear box and of the output shaft (6) of the gear box correspond with regard to the gear ratio of the engaged gear in the gear box (5) and for detecting a zero torque in the gear box (5) if a different occurs.

An arrangement and a method to detect a zero moment in a gear box

BACKGROUND OF THE INVENTION AND PRIOR ART

The invention relates to an arrangement and a method for detecting a zero torque in a gearbox according to the preambles of the claims 1 and 8.

In connection with a disengagement of a gear in a stepped gearbox in a vehicle without the use of a clutch, it is important that a torqueless state is the case in the mesh of teeth of the engaged gear. Otherwise, a disengagement of the gear results in a wear of the gear box and control members. Furthermore, in connection with a disengagement of a gear; when a torque is transmitted to the mesh of teeth, a comfort disturbing oscillation in the power train is initiated. The torqueless state in the gearbox has here been called a zero torque. A zero torque is obtained in the mesh of teeth of the gearbox when the engine neither transmits a positive or a negative torque. A positive torque is obtained when the engine drives the vehicle and a negative torque when the vehicle motor brakes. However, it is difficult to measure and detect a zero torque in a mesh of teeth in a gearbox.

SE 502 807 shows a method for controlling the torque of an engine with the purpose of obtaining a zero torque level in a gear box in connection with a gear changing. Here, the engine torque, which is required for the specific engine in order for a

zero torque to be obtained in the gearbox, is calculated. Thereafter, the engine is supplied with a necessary amount of fuel in order to provide the calculated engine torque.

SE 504 717 shows a further development of the above cited method. In addition to a calculation of the engine torque, which is required for a zero torque to be obtained in the gear box, also a measurement is made, in connection with each gear changing, in order to evaluate if the calculated and modulated engine torque, in connection with a disengagement of a gear, was a correct zero torque. If this was not the case, a correction is performed at a following gear changing of the calculated zero torque with a value, which corresponds to the fault at the previous disengagement of the gear.

SE 507 436 shows a further method for allowing a correction of a calculated and modulated engine torque. Here, the number of revolutions of the output shaft of the gearbox is measured. If the shaft discloses a change of the number of revolutions immediately after that a gear has been disengaged, it is established that no zero torque was the case in the gearbox when the gear was disengaged. In such cases, a correction is performed at a following gear changing of a calculated engine torque with a value related to the amplitude of the change of number of revolutions of the output shaft of the gearbox.

SE 507 869 shows a method for controlling the engine torque at a gear changing of a vehicle. Here, the torsion of the driveshafts of the vehicle is measured as a measure of the actual torque in the gearbox. An actual value of the torsion is determined by signal treatment of measuring signals concerning the actual engine speed and the number of revolutions of the driving wheels. The torque of the engine is here adjusted until the torsion is zero whereupon a disengagement of the engaged gear is performed.

The above known methods are functional but require advanced calculations which comprise a plurality of included parameters in order to be able to determine that engine torque, which corresponds to a zero torque in the gear box. In addition, it is complicated to supply fuel in such an amount that an engine exactly obtains a calculated engine torque, since, inter alia, the quality of the fuel may vary. Furthermore, the known methods are relatively time demanding and it would be desired to be able to reduce the time it takes to control the engine torque and for detecting a zero torque in the gear box such that the engaged gear can be disengaged.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a method and an arrangement for detecting a zero torque in a gearbox in a simple and reliable way. Another object is to provide a detection of a zero torque, which allows a quick and uncomplicated control of the torque of an engine towards a zero torque in the gearbox.

The first mentioned object is achieved by the initially mentioned arrangement and method, which are characterised by that which is mentioned in the characterising parts of the claims 1 and 8. In the mesh of teeth between the teeth in a gearbox, there is always a certain play. Such a play results in, when an engine delivers a positive torque, that the teeth in a mesh of teeth are in a first turning position in relation to each other and, when the engine delivers a negative torque, that the teeth in a mesh of teeth are in a second turning position in relation to each other. In connection with a change from a positive torque to a negative torque in the gearbox, a turning of the teeth in the mesh of teeth takes place between said first and second turning positions. Usually, this play appears during a short time period of 0.05 to 0.10 seconds. Since the control unit, with a frequency of at the lowest 50 Hz but preferably a higher frequency, compares the number of revolutions of the input and output shafts of the gear

box, said play in the gear box may be detected as a deviation of the number of revolutions between said shafts when said turning occurs. Advantageously, the read parameters are the number of revolutions of the input shaft of the gearbox and of the output shaft of the gearbox. But also other parameters, which stand in a relation to these parameters, may be measured. For example, the engine speed may be measured instead for the number of revolutions of the input shaft in the gearbox if the engine and the input shaft in the gearbox are fixedly connected.

According to a preferred embodiment of the present invention, the control unit is arranged for detecting a zero torque in the gearbox when such a deviation attains a determined value. Since disturbances of different kinds may lead to smaller fluctuations of the measured parameter values, such a deviation ought at least attain a minimum value before one for certain may detect that a zero torque is the case in the gear box. Advantageously, said value of the deviation varies for different gears. Since the play in the mesh of teeth for low gears is larger than for high gears, it is suitable to let said value be larger for low gears than for high gears.

According to another preferred embodiment of the invention, the control unit is arranged to calculate a function, which comprises a relationship between the first parameter and the second parameter. The relationship between said parameters discloses a constant relationship when a positive or a negative torque is the case in the gearbox. Advantageously, such a function comprises also a correction factor, which comprises the gear ratio of the engaged gear in the gearbox. With a suitable such correction factor, the value of the function is at least theoretically exactly equal to 1.00 when a positive or a negative torque is the case in the gearbox. If the engine is controlled such that a change from a positive torque to a negative torque is obtained in the gear box, the input shaft of the gear box will, because of said play, during a changeover period, obtain a lower number of revolu-

tions in relation to the output shaft. Said function thereby obtains a value which is a couple of percents lower than 1.00. In a corresponding way, if the engine is controlled such that a change from a negative torque to a positive torque in the gear box is obtained, the input shaft of the gear box will, during a changeover period, obtain a higher number of revolutions in relation to the output shaft. Said function thereby obtains a value which is a couple of percents higher than 1.00. By calculating the value of such a function, it may be determined in a relatively uncomplicated way when a change in the gearbox between a positive and a negative moment occurs. Consequently, during said change a zero torque is the case in the gearbox.

According to another preferred embodiment of the invention, when a gear changing is desired to be performed, the control unit is arranged to control the output torque of the engine such that it is adjusted in such a direction that a zero torque is allowed to be indicated in the gear box. For example, the fuel supply to the engine is controlled in order to adjust the output torque of the engine. If a positive torque is the case in the gearbox, the supply of fuel to the engine is reduced until a negative torque is obtained such that a zero torque may be detected during the changeover period. If instead a negative torque is the case in the gearbox, the supply of fuel to the engine is increased until a positive torque is obtained such that a zero torque may be detected during the change period. Here, it is not necessary to exactly calculate how much fuel is to be supplied to the engine, but the amount of fuel may be increased or reduced in a substantially arbitrary but functionally way. Thereby, a zero torque may be obtained and detected relatively quickly.

According to another preferred embodiment of the invention, when a gear changing is desired to be performed, the control unit is arranged to activate a gear changing mechanism, which disengages the engaged gear when a zero torque is detected in the gear box. As soon as a deviation related to the number of

revolutions of the input and output shafts of the gearbox is detected, the engaged gear is disengaged. Since the torqueless state in the gearbox usually only is the case during a time period of 0.05 to 0.10 seconds, a relatively quick activation of the gear changing mechanism is required.

According to another preferred embodiment of the invention, the output shaft of the gearbox is arranged to deliver a torque to a power train in a vehicle. Advantageously, the above described arrangement and method are used in a vehicle. Parameters related to the number of revolutions of the output shaft of the gearbox may in principle be measured anywhere at the power train.

SHORT DESCRIPTION OF THE DRAWING

In the following, a preferred embodiment of the invention is described as an example with reference to the attached drawing, in which:

Fig 1 shows schematically an arrangement according to the present invention and

Fig 2 shows as a graph the value of a zero torque detecting function with the time during operation of a vehicle.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

Fig 1 shows schematically selected parts of a vehicle. The vehicle is driven by an engine 1. The engine 1 drives, via an output shaft 2 and a clutch 3, an input shaft 4 of a stepped gearbox 5. The stepped gearbox 5 comprises a plurality of gears with a varying gear ratio. An output shaft 6 extends from the gearbox 5, which output shaft is in engagement with a power train of the vehicle. The power train comprises a propeller shaft 7, an end

gear 8 and driveshafts 9, which are connected to the driving wheels 10 of the vehicle. In this embodiment, the clutch 3 is intended to be operated mainly only at the start and stop of the vehicle. At a gear changing between different gears in the gearbox 5 during travel, the clutch 3 is not intended to be operated. Consequently, the gear changing occurs with the clutch 3 in engagement as a rigid connection, which transmits a driving force between the output shaft 2 of the engine 1 and the input shaft 4 of the gearbox.

The gear changing system of the vehicle comprises an electric control unit 11, which is arranged to obtain information from a driver by a gear lever 12 when a gear changing is desired to be performed. Thereby, the control unit 11 activates a fuel injection unit 13 in order to control the torque of the engine 1 such that a zero torque can be obtained in the gearbox 5. When a zero torque is obtained in the gearbox 5, the control unit 11 activates a gear changing mechanism 14, which disengages the actual gear in engagement. Thereafter, the control unit 11 controls the fuel injection amount through the fuel injection unit 13 such that the engine 1 obtains a number of revolutions such that the gear changing mechanism 14 can engage a new gear.

The arrangement for detecting a zero torque in the gear box 5 comprises a first sensor 15 arranged to sense the number of revolutions of the input shaft 4 of the gear box and a second sensor 16 arranged to sense the number of revolutions of the output shaft 6 of the gear box. Alternatively, already existing sensors in the vehicle may be used with advantage, which, for example, sense the speed of the engine 1, which corresponds to number of revolutions of the input shaft 4 of the gear box, and the number of revolutions of the propeller shaft 7, which corresponds to the number of revolutions of the output shaft 6 of the gear box. The first 15 and second 16 sensors send a signal, related to the measured number of revolutions of the respective shaft 4, 6, to the control unit 11. The control unit 11 calculates

with a frequency of, for example, 100 Hz a zero torque detecting function f. The control unit 11 calculates the function f at least when a gear changing signal is obtained from the gear lever 12 but may also with advantage calculate the function f substantially continuously. The function f states the relation between the number of revolutions of the input shaft 4 of the gearbox and the number of revolutions of the output shaft 6 of the gearbox corrected with the gear ratio of the engaged gear. The value of the function f is, at a completely rigid connection in the gearbox, 1.00 at least theoretically when a positive or a negative torque is transmitted in the gearbox 5.

Fig 2 shows a graph, which describes how the value of the function f varies with the time t during the travel of a vehicle. During a first time period I, the vehicle is motor braked and it is thus driven with a negative torque in the gearbox 5. In the mesh of teeth between the teeth in a gearbox 5, there is always at least a small play. Such a play results in, when the engine 1 delivers a positive torque, that the teeth are located in a mesh of teeth in a first turning position in relation to each other and, when the engine 1 delivers a negative torque, that the teeth are located in a mesh of teeth in a second turning position in relation to each other. During the first time period I, when a negative torque is transmitted in the gear box 5, the teeth are in the second turning position and the input shaft 4 and the output shaft 5 of the gearbox 5 disclose a completely corresponding number of revolutions with regard to the engaged gear in the gearbox. Consequently, the function f is here substantially constant 1.00. The smaller variations of the function f, which occurs, originate from vibration motions between the teeth in engagement and measuring disturbances.

In the end of the first time period I, the driver of the vehicle decides to engage a new gear. A control signal is sent from the gear lever 12 to the control unit 11, which activates the fuel injection unit 13 such that the engine 1 obtains an increased fuel

supply. The torque of the engine 1 delivered to the input shaft 4 of the gearbox increases and a positive torque is obtained in the gearbox 5. In connection with a change from a negative torque to a positive torque, a turning of the teeth in the mesh of teeth take place from the second turning position to the first turning position. Usually, such a play appears during a short time period II of 0.05 to 0.10 seconds. During such a turning of the teeth, a zero torque is obtained in the gearbox. Since the control unit 11 obtains information, with at least a frequency of 100 Hz, about the number of revolutions of the input 4 and output 6 shafts of the gear box, said play in the gear box 5 may be detected as a deviation of number of revolutions between the shafts 4, 6 when said turning takes place. The input shaft 4 obtains in the play, during the time period II, a higher number of revolutions than the output shaft 6. The value f of the function calculated by the control unit 11 therefore, during the time period II, a higher value than 1.00 obtains. In order to with certainly detect that a torqueless state is the case, the control unit 11 detects a zero torque in the gearbox 5 first when a deviation from the value 1.00 attains a determined value a_1. The value of the deviation a_1 may vary for different gears. In Fig 2, the deviation a_1 is of about 1%. When said deviation is obtained, the control unit 11 activates the gear changing mechanism 14, which disengages the engaged gear. Thereafter, the control unit 11 activates the injection unit 13 in order to control the speed of the engine 1 such that a new gear may be engaged.

During the following time period III, the vehicle is driven with a positive torque in the gearbox 5. During the third time period III, the teeth are in the first turning position and the input shaft 4 and the output shaft 5 of the gear box 5 disclose a corresponding number of revolutions with regard to the engaged gear in the gear box 5. The function f is here substantially constant 1.00. At the end of the third time period III, the driver initiates that a new gear is to be engaged. A control signal is sent from the gear lever 12 to the control unit 11, which activates the fuel injection

unit 13 such that the fuel amount supplied to the engine 1 decreases. The delivered torque of the engine 1 to input shaft 4 of the gear box decreases and a negative torque is obtained in the gearbox 5. In connection with the change from a positive torque to a negative torque in the gearbox 5 a turning of the teeth in the mesh of teeth from the first to the second turning position occurs. The input shaft 4 obtains, during said turning, a lower number of revolutions than the output shaft 6. The function value f calculated by the control unit 11 obtains, during the time period IV, therefore a lower value than 1.00. In order to with certainly establish that a torqeuless state is the case, the control unit 11 detects a zero torque in the gearbox 5 first when such a deviation attains a determined value a_2. The value of the deviation a_2 varies for different gears and corresponds substantially the value a_1 for the corresponding gear. In Fig 2, the deviation a_2 is about 1%. When a function value f is obtained which corresponds to the deviation a_2, the control unit 11 activates the gear changing mechanism 14, which disengages the existing gear in engagement. Thereafter, the control unit 11 activates the injection unit 13 in order to adjust the fuel injection amount for the purpose of controlling the speed of the engine 1 such that a new gear may be engaged.

The invention is not in any way restricted to the described embodiment but may be varied freely within the scope of the claims. The invention is not restricted to only be used in order to allow a torqueless disengagement of a gear in a gear box but may be used in an essentially arbitrary situation where it is desired for detecting a zero torque in a gearbox. In Fig 1, a manual gear changing method is described where the driver with the gear lever 12 engages a desired gear. The invention is of course also applicable in connection with automatic and semi-automatic gear changing methods, i.e. when the control unit 11 determines when a gear changing is to occur and which gear that is to be engaged.

Claims

1. An arrangement for detecting a zero torque in a stepped gear box, wherein the stepped gear box (5) comprises an input shaft (4) arranged to obtain a torque from an engine (1) and an output shaft (6) arranged to deliver a torque to an object (7-9), and wherein the arrangement comprises a first sensor (15) arranged to sense a first parameter, which is related to the number of revolutions of the input shaft (4) of the gear box, a second sensor (16) arranged to sense a second parameter, which is related to the number of revolutions of the output shaft (6) of the gear box, and a control unit (11) arranged to receive measurement values concerning said first and second parameter, characterised in that the control unit (11) is arranged to compare if the number of revolutions of the input shaft (4) of the gear box and of the output shaft (6) of the gear box correspond with regard to the gear ratio of the engaged gear in the gear box (5) and for detecting a zero torque in the gear box (5) if a deviation occurs.

2. An arrangement according to claim 1, characterised in that the control unit (11) is arranged for detecting a zero torque in the gear box (5) when such a deviation attains a determined value (a_1, a_2).

3. An arrangement according to claim 2, characterised in that said determined value of the deviation (a_1, a_2) varies for different gears.

4. An arrangement according to any one of the preceding claims, characterised in that the control unit (11) is arranged to calculate a function (f), which comprises the relationship between the first parameter and the second parameter.

5. An arrangement according to any one of the preceding claims, characterised in that when a gear changing is desired to be performed, the control unit (11) is arranged to control the

output torque of the engine (1) such that it is adjusted in a direction such that a zero torque is allowed to be indicated in the gear box (5).

6. An arrangement according to any one of the preceding claims, characterised in that when a gear changing is desired to be performed, the control unit (11) is arranged to activate a gear changing mechanism (14) which disengages the engaged gear when a zero torque is detected in the gear box (5).

7. An arrangement according to any one of the preceding claims, characterised in that the output shaft (6) of the gear box is arranged to deliver a torque to a power train (7-9) in a vehicle.

8. A method for detecting a zero torque in a stepped gear box, wherein the stepped gear box (6) comprises an input shaft (4) arranged to obtain a torque from an engine (1) and an output shaft (6) arranged to deliver a torque to an object (7-9), and wherein the method comprises the steps of sensing a first parameter related to the number of revolutions of the input shaft (4) of the gear box, sensing a second parameter related to the number of revolutions of the output shaft (6) of the gear box and receiving measurement values concerning said first and second parameter, characterised in that the method also comprises the steps of comparing if the number of revolutions of the input shaft (4) and the output shaft (5) of the gear box correspond with regard to the gear ratio of the engaged gear in the gear box and detecting a zero torque in the gear box (5) if a deviation occurs.

9. A method according to claim 8, characterised by detecting a zero torque in the gear box (5) when such a deviation attains a determined value (a_1, a_2).

10. A method according to claim 9, <u>characterised by</u> varying said determined value of the deviation (a_1, a_2) for different gears.

11 A method according to any one of the preceding claims 8-10, <u>characterised by</u> calculating a function (f) which comprises the relationship between the first parameter and the second parameter.

12. A method according to any one of the preceding claims 8-11, <u>characterised by</u>, when a gear changing is desired to be performed, controlling the output engine torque such that it is adjusted in such a direction that a zero torque is allowed to be indicated in the gear box (5).

13. A method according to any one of the preceding claims 8-12, <u>characterised by</u>, when a gear changing is desired to be performed, activating a gear changing mechanism (14) which disengages the engaged gear when a zero torque is detected in the gear box (5).

14. A method according to any one of the preceding claims 8-13, <u>characterised in</u> that the output shaft (6) of the gearbox delivers a torque to a power train (7-9) in a vehicle.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/02766

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60K 41/06, F16H 61/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60K, F16H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 507436 C2 (SCANIA CV AB), 8 June 1998 (08.06.98) --	1-14
A	SE 504717 C2 (SCANIA CV AB), 14 April 1997 (14.04.97) --	1-14
A	SE 502807 C2 (SCANIA CV AB), 22 November 1996 (22.11.96) --	1-14
A	US 5582558 A (F.A. PALMERI ET AL), 10 December 1996 (10.12.96) -- ---------	1-14

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search	Date of mailing of the international search report
18 February 2002	12-03-2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Per-Olof Warnbo / MRo Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/01/02

International application No.

PCT/SE 01/02766

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE 507436 C2	08/06/98	EP 0993388 A	19/04/00
		SE 9702611 A	08/06/98
		WO 9902360 A	21/01/99
SE 504717 C2	14/04/97	BR 9700798 A	06/10/98
		EP 0787619 A	06/08/97
		EP 0873563 A	28/10/98
		JP 9264165 A	07/10/97
		JP 11505926 T	25/05/99
		SE 9600454 A	14/04/97
		US 5859886 A	12/01/99
		US 5866809 A	02/02/99
SE 502807 C2	22/11/96	DE 19509139 A	16/11/95
		SE 9401653 A	14/11/95
		US 5595551 A	21/01/97
US 5582558 A	10/12/96	AU 712265 B	04/11/99
		AU 6680196 A	26/02/97
		BR 9609805 A	06/07/99
		DE 69616060 D	00/00/00
		EP 0837788 A,B	29/04/98
		WO 9704983 A	13/02/97